Southern Research Institute

October 11, 1990

Mr. Jeff Payne
AQCS Engineer
Intermountain Power Service Corporation
Brush Wellman Road
Rt. 1 Box 864
Delta, UT 84624

Subject: Laboratory Analysis of IPP Dustcake Ash Samples

Dear Mr. Payne:

We recently performed several analyses on two dustcake ash samples from IPP that were sent to me by Rich Miller of GE Environmental Systems. These samples are:

Unit 1 compartment 1B04 bag J-11 7/24/90
Unit 2 compartment A01 bag J-11 7/24/90

Recent filtration experience at IPP has shown that pressure drops have increased significantly since we characterized the baghouse following startup. Since residual dustcake weights have remained relatively unchanged during this period, it is expected the increase should be attributable to changes in the ash. We used several of the tests developed for EPRI to measure some of the ash properties that influence filtration performance. The following table compares measured characteristics of these two recently obtained samples with values representative of earlier dustcake ash samples taken from IPP. (This early ash data is taken from the ash database included in our two-part JAPCA paper published in 1989.)

MEASURED QUANTITY	ASH SAMPLE		
	Unit 1	Unit 2	EPRI Database
relative gas flow resistance, in H_2O·min·ft/lb	12.2	10.1	5.7
compacted bulk porosity, %	43.5	41.2	42
uncompacted bulk porosity, %	74.5	71.7	-
estimated dustcake porosity, %	63	61	62
drag-equivalent diameter, μm	2.27	2.78	3.54
specific surface area, m^2/g	2.75	2.08	1.35
volumetric median diameter, μm	6.8	7.6	7.0
morphology factor	7.4	6.1	3.9

(The true particle density was not measured for the Unit 1 and 2 samples. An assumed value of 2.35 g/cm^3 was used.)

The relative gas flow resistance, R, of the ash has doubled. Thus, for the same residual dustcake weight and air-to-cloth ratio, the expected tubesheet pressure drop would now be double the value expected from the earlier ash sample. The parameters to examine in looking for an explanation for the increase in R are the porosity of the dustcake, and the size and shape of the ash particles.

The dustcake porosity has not changed. The volumetric median diameter of the ash has not changed. But there is a significant increase in the specific surface area of the ash. All other factors being equal, higher surface area results in higher flow resistance.

The data indicate that the pressure drop has increased due to increased specific surface area (note the differences in drag-equivalent diameter and specific surface area). Since the volumetric median diameters of the samples are all quite similar, an examination of the sizing data was conducted to determine if the increased surface area could be due to more small particles in the sample. Results of this comparison are shown in the attached graph (2759 refers to the sample from Unit 1, and 2760 refers to the sample from Unit 2). Differences in the populations of relatively small particles do not account for the observed difference in surface area.

We believe the increase in specific surface area and subsequent increase in filtering pressure drop must be attributable to more irregular particle shape in the newer samples. Factors that could cause this change include different coal chemical composition, milling performance, and combustion parameters (temperatures, residence time, etc.).

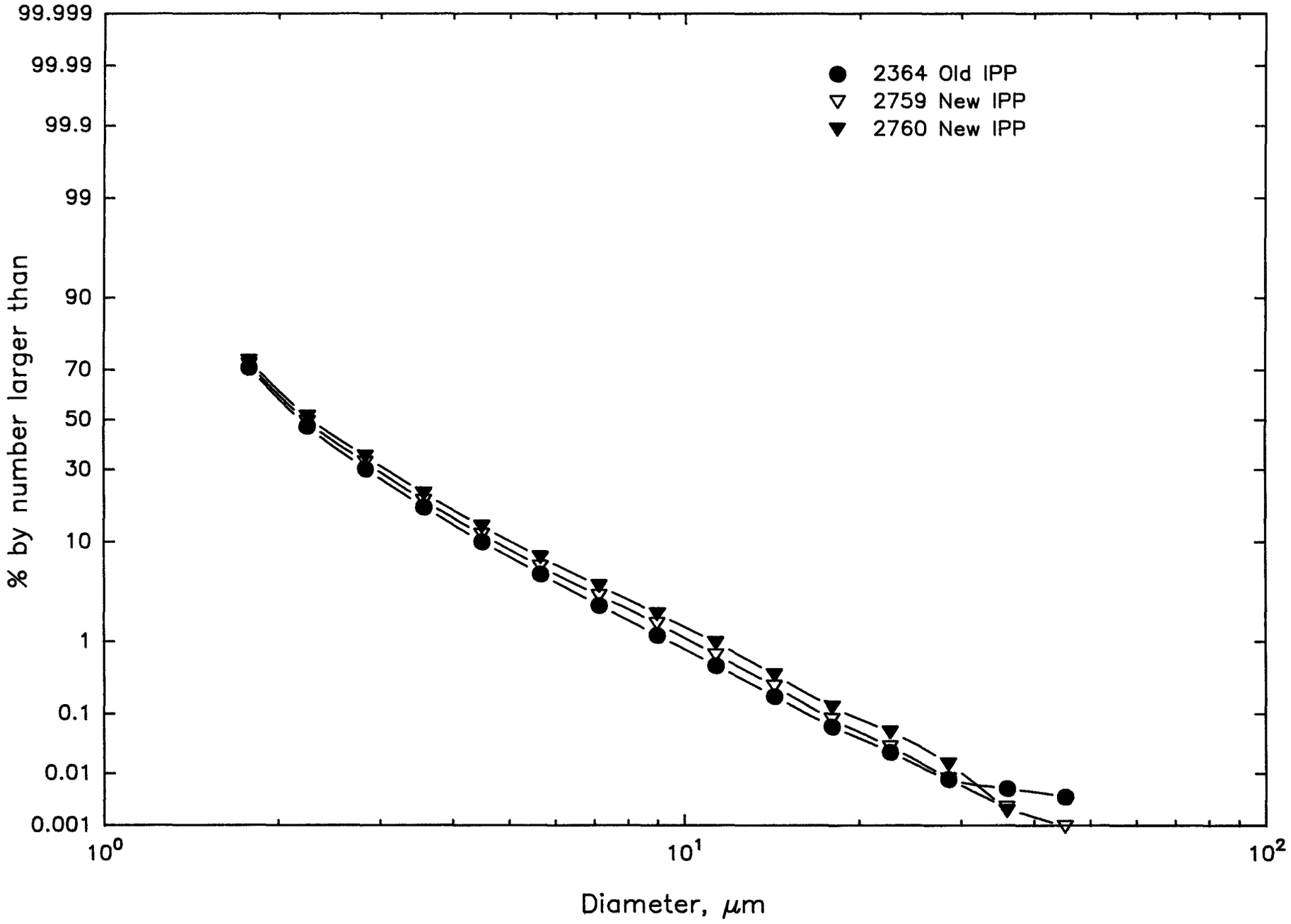
We have no plans to perform additional analyses (such as SEM, ash chemistry). Please let us know if you have questions or would like to discuss our findings, can suggest a cause for the increase in particle specific surface area, or would be interested in any further tests. We would also like to know what effects on performance you see from the addition of sonic horns.

Yours truly,

P. Vann Bush

P. Vann Bush
Head, Applied Physics Section

cc: Ramsay Chang, EPRI
Rich Miller, GE
TRS, DHP, KMC, MSR


99.999
99.99
99.9
99
90
70
50
30
10
1
0.1
0.01
0.001
% by number larger than
10^0
10^1
10^2
Diameter, μm
2364 Old IPP
2759 New IPP
2760 New IPP

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October 29, 1990

Mr. Jeff Payne
AQCS Engineer
Intermountain Power Service Corporation
Brush Wellman Road
Rt. 1 Box 864
Delta, UT 84624

Subject: Laboratory Analysis of IPP Dustcake Ash Samples

Dear Mr. Payne:

We made some additional measurements of dustcake ash samples from IPP. We measured the size distributions with a Shimadzu SA-CP4 centrifugal sedimentation analyzer. These data show that the samples collected this past August have a significantly smaller median particle size than a sample collected in January 1987. We then repeated the Coulter Counter measurement of the size distribution of the sample from 1987. The number reported earlier (a measurement made in 1987) was apparently in error. Thus, we conclude the particle size distribution of the ash being collected in the IPP baghouses has changed. As mentioned in my previous letter, smaller particle size would explain the differences in specific surface area and relative gas flow resistance we measured. The following table compares measured characteristics of these two recently obtained samples with values representative of earlier dustcake ash samples taken from IPP.

MEASURED QUANTITY	ASH SAMPLE		
	Unit 1- 1990	Unit 2- 1990	Unit 1- 1987
relative gas flow resistance, in H_2O·min·ft/lb	12.2	10.1	5.7
compacted bulk porosity, %	43.5	41.2	42
uncompacted bulk porosity, %	74.5	71.7	-
estimated dustcake porosity, %	63	61	62
drag-equivalent diameter, μm	2.27	2.78	3.54
specific surface area, m^2/g	2.75	2.08	1.35
median diameter, μm (1)	6.8	7.6	**9.9**
median diameter, μm (2)	**6.22**	**6.99**	**9.71**
morphology factor	7.4	6.1	3.9

(1) measured with a Coulter Counter

(2) measured with a Shimadzu SA-CP4 centrifugal particle size analyzer

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Differences in the particle size distributions do appear to be a plausible cause of the observed difference in baghouse performance. The same factors that could alter particle shape could alter the size distribution: different coal chemical composition, milling performance, and combustion parameters (temperatures, residence time, etc.).

Yours truly,

P. Vann Bush

P. Vann Bush
Head, Applied Physics Section

cc: Ramsay Chang, EPRI
Rich Miller, GE
TRS, DHP, KMC, MSR